(B) AMENDMENTS TO THE CLAIMS

1. (Currently amended) A method for seismic data processing, comprising:

constructing explicit depth extrapolation operators with variable operator lengths depending on maximum dip angle, accuracy condition, and wavenumber; ~~and~~

constructing operator tables using the explicit depth extrapolation operators~~.~~ <u>having the smallest operator length satisfying the accuracy condition at the maximum dip angle for each of a plurality of wavenumbers; and</u>

<u>performing depth migration using the explicit depth extrapolation operator in a sub-domain at a depth having the smallest operator length from the operator tables for the highest wavenumber in the sub-domain at the depth</u>.

2. (Canceled)

3. (Original): The method of claim 1, wherein the step of constructing operator tables comprises:

selecting a maximum dip angle;

selecting a type of operator;

selecting an accuracy condition for the type of operator;

selecting a plurality of wavenumbers; and

performing the following steps for each of the plurality of wavenumbers:

selecting a plurality of operator lengths for the selected wavenumber; and

performing the following steps for each of the plurality of operator lengths:

determining if the selected type of operator with the selected operator length satisfies the selected accuracy condition at the selected maximum dip angle at the selected wavenumber;

determining if the operator length is the smallest operator length satisfying the accuracy condition at the selected maximum dip angle for the selected wavenumber; and

storing the operator length in an operator table if the operator length is the smallest operator length satisfying the accuracy condition at the maximum dip angle for the selected wavenumber.

4. (Previously amended): The method of claim 3, wherein the steps performed for each wavenumber comprise:

selecting a plurality of pairs of first operator half-lengths and second operator half-lengths for the selected wavenumber; and

performing the following steps for each of the plurality of pairs of first operator half-lengths and second operator half-lengths:

determining if the selected type of operator with the selected pair of first operator half-length and second operator half-length satisfies the selected accuracy condition at the selected maximum dip angle at the selected wavenumber;

determining if the first operator half-length is the smallest first operator half-length satisfying the accuracy condition for the selected wavenumber and the second operator half-length is the smallest second operator half-length satisfying the accuracy condition for the selected wavenumber; and

storing the pair of first operator half-length and second operator half-length in an operator table if the first operator half-length is the smallest first operator half-length satisfying the accuracy condition for the selected wavenumber and the second operator half-length is the smallest second operator half-length satisfying the accuracy condition at the selected maximum dip angle for the selected wavenumber.

5. (Previously amended): The method of claim 1, wherein the step of constructing operator tables comprises:

selecting a maximum dip angle;

selecting a type of operator;

selecting an accuracy condition for the type of operator;

determining preliminary operator tables with variable operator lengths;

selecting a plurality of wavenumbers; and

performing the following steps for each of the plurality of wavenumbers:

selecting a smallest operator length in the preliminary operator tables satisfying the accuracy condition for the selected wavenumber; and

storing the smallest operator length in an operator table.

6. (Previously amended): The method of claim 5, wherein the steps performed for each wavenumber comprise:

selecting a pair of smallest first operator half-length and smallest second operator half-length in the preliminary operator tables satisfying the accuracy condition for the selected wavenumber; and

storing the pair of smallest first operator half-length and smallest second operator half-length in an operator table.

7. (Previously amended): The method of claim 2, wherein the step of performing depth migration comprises:

selecting a seismic data set;

selecting a plurality of depths in the seismic data set;

selecting sub-domains for each of the plurality of depths;

determining a velocity model for the seismic data set and the plurality of depths;

determining a lowest velocity for each sub-domain from the velocity model;

selecting an operator table with variable operator lengths;

selecting a plurality of frequencies in the selected sub-domain; and

performing the following steps for each of the plurality of frequencies:

performing the following steps for each of the plurality of depths:

performing the following steps for each of the sub-domains at the depth:

calculating a highest wavenumber in the sub-domain from the frequency and the lowest velocity for the sub-domain;

selecting a maximum operator length for the calculated highest wavenumber from the operator table;

applying operators from the operator table with operator lengths no greater than the maximum operator length to the selected sub-domain.

8. (Previously amended): The method of claim 7, wherein the operator table with variable operator lengths comprises explicit extrapolation operators with variable operator lengths.

9. (Previously amended): The method of claim 7, wherein the step of selecting an operator table with variable operator lengths further comprises:

interpolating the operator table with variable operator lengths.

10. (Original): The method of claim 7, wherein each operator length comprises a pair of first operator half-length and second operator half-length.

11. (Original): The method of claim 3, wherein the step of selecting a type of operator comprises applying the following formula:

$$P(x_i, y_j, \omega, z+\Delta z) =$$

$$\sum_{l=-L(k_\omega^{max}(D,z))}^{L(k_\omega^{max}(D,z))} \sum_{m=-M(k_\omega^{max}(D,z))}^{M(k_\omega^{max}(D,z))} W(x_l, y_m, k_\omega(x_i, y_j, z), \Delta z)\, P(x_i - x_l, y_j - y_m, \omega, z),$$

where $P(x_i, y_j, \omega, z+\Delta z)$ is a seismic wavefield at lateral location $x_i = i \cdot \Delta x$, $y_j = j \cdot \Delta y$, and depth $z+\Delta z$; ω is angular frequency; $P(x_i, y_j, \omega, z)$ is a seismic wavefield in a sub-domain D at depth z; Δx, Δy, and Δz are step lengths in the x-, y- and z-coordinate directions, respectively; $L(k_\omega^{max}(D, z))$ and $M(k_\omega^{max}(D, z))$ are operator half-lengths in the x- and y- coordinate directions, respectively, for the highest wavenumber $k_\omega^{max}(D, z)$ in the sub-domain D at depth z; $W(x_i, y_j, k_\omega(x_i, y_j, z), \Delta z)$ is an explicit depth extrapolation operator; and $k_\omega(x_i, y_j, z)$ is a local wavenumber.

12. (Original): The method of claim 11, wherein the wavenumber $k_\omega(x_i, y_j, z)$ is given by the formula:

$$k_\omega(x_i, y_j, z) = \frac{\omega}{c\,(x_l, y_j, z)},$$

where $c(x_i, y_j, z)$ is a local propagation velocity.

13. (Original): The method of claim 11, wherein the highest wavenumber $k_\omega^{max}(D, z)$ for a frequency ω for a sub-domain D at depth z is given by the formula:

$$k_\omega^{max}(D, z) = \frac{\omega}{c_{min}(D, z)},$$

where $c_{min}(D, z)$ is the lowest velocity for the sub-domain D at depth z.

14. (Original): The method of claim 3, wherein the step of step of selecting a type of operator comprises applying the following formula:

$$P(x_i, \omega, z + \Delta z) = \sum_{l=-L(K_\omega^{max}(D,z))}^{L(K_\omega^{max}(D,z))} W(x_l, k_\omega(x_i, z), \Delta z)\, P(x_i - x_l, \omega, z)\,,$$

where $P(x_i, \omega, z+\Delta z)$ is a seismic wavefield at lateral location $x_i = i \cdot \Delta x$ and depth $z+\Delta z$, ω is angular frequency, $P(x_i, \omega, z)$ is a seismic wavefield in a sub-domain D at depth z, Δx and Δz are step lengths in the x- and z-coordinate directions, respectively, $L(k_\omega^{max}(D, z))$ is an operator half-length in the x-coordinate direction for the highest wavenumber $k_\omega^{max}(D, z)$ in the sub-domain D at depth z; $W(x_i, k_\omega(x_i, z), \Delta z)$ is an explicit depth extrapolation operator, and $k_\omega(x_i, z)$ is a local wavenumber.

15. (Original): The method of claim 14, wherein the wavenumber $k_\omega(x_i, z)$ is given by the formula:

$$k_\omega(x_i\ , z) = \frac{\omega}{c\ (x_i, z)},$$

where $c(x_i, z)$ is a local propagation velocity.

16. (Original): The method of claim 3, wherein the step of selecting a type of operator comprises applying the following formula:

$$P(x_i, y_j, \omega, z+\Delta z) = \sum_{l=0}^{L(k_\omega^{max}(D,z))} W_l(k_\omega(x_i, y_j, z), \Delta z)\, h_l(x_i, y_j, \omega, z),$$

where $P(x_i, y_j, \omega, z+\Delta z)$ is a seismic wavefield at lateral location $x_i = i\cdot\Delta x$, $y_j = j\cdot\Delta y$, and depth $z+\Delta z$; ω is angular frequency; $P(x_i, y_j, \omega, z)$ is a seismic wavefield in a sub-domain D at depth z; Δx, Δy, and Δz are step lengths in the x-, y- and z-coordinate directions, respectively; $L(k_\omega^{max}(D, z))$ is an operator length for the highest wavenumber $k_\omega^{max}(D, z)$ in the sub-domain D at depth z; $W_l(k_\omega(x_i, y_j, z), \Delta z)$ is an explicit depth extrapolation operator expressed in cylindrical coordinates; $k_\omega(x_i, y_j, z)$ is a local wavenumber; and $h_l(x_i, y_j, \omega, z)$ are auxiliary fields resulting from applying recursive 2D Chebyshev filters to the seismic wavefield $P(x_i, y_j, \omega, z)$.